# Greater rates of cortical thinning in cognitively normal adults with hearing complaints

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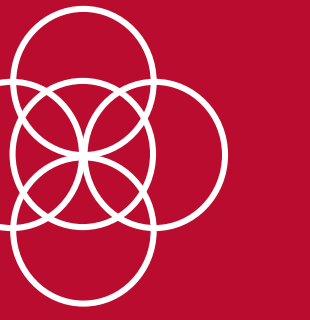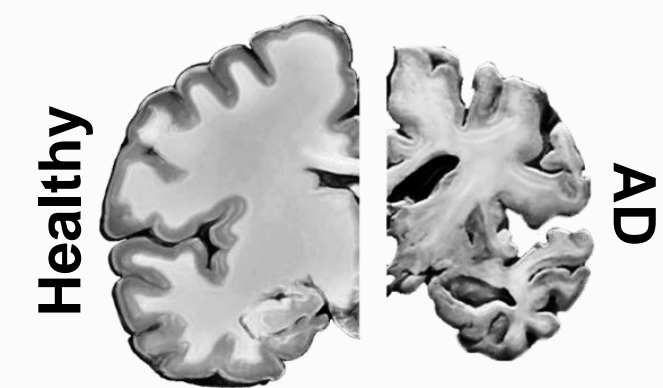
BACKGROUND

- Auditory dysfunction among cognitively normal adults may predict future cognitive decline and dementia[1]
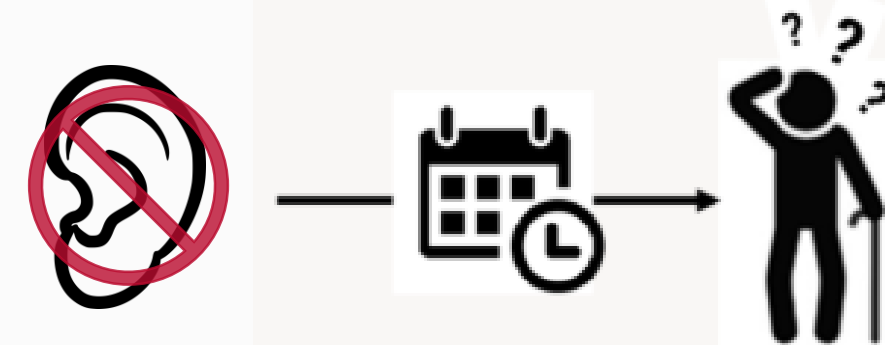
- Little is known about the biological basis for these associations

- Alzheimer's disease (AD) is associated with a signature pattern of cortical thinning, distinct from healthy aging[2,3]
  - Includes temporo-parietal regions known to be involved in auditory perception[4]
  - Thinning in these areas represents a potential neural substrate linking auditory and cognitive dysfunction

OBJECTIVE

Investigate whether perceived hearing problems (PHPs) are associated with greater rates of thinning in temporal and parietal areas in an AD risk-enriched cohort of cognitively normal adults

METHODS

Participants:

- N = 124 cognitively healthy adults enrolled in the Wisconsin Registry for Alzheimer's Prevention (WRAP):

Characteristic	Value
Age at most recent MRI, y, mean (SD)	63.1 (6.1)
Female, n (%)	87 (70.2)
Family history positive, n (%)	86 (69.4)
Time between MRI scans, y, mean (SD)	3.0 (1.4)
WRAT-III Standardized Reading Score, mean (SD)	107.8 (9.6)

Perceived Hearing Problems (PHPs):

- Participants completed a 5-item questionnaire assessing overall hearing problems, multi-talker speech perception, listening effort, sound clarity, and spatial hearing

- Responses averaged to give single measure of perceived hearing problems (PHPs)

- Ten-point scale with higher numbers indicating greater perceived problems

MRI:

- Included participants with at least 2 structural MRI scans ≥ 1 year apart
- Regional cortical thickness measured using Freesurfer
- 9 bilateral regions of interest (ROIs) in temporal and parietal cortex

Statistical Analyses:

- Separate multivariable linear regressions used to examine association between average PHPs and annualized change in thickness for each ROI:
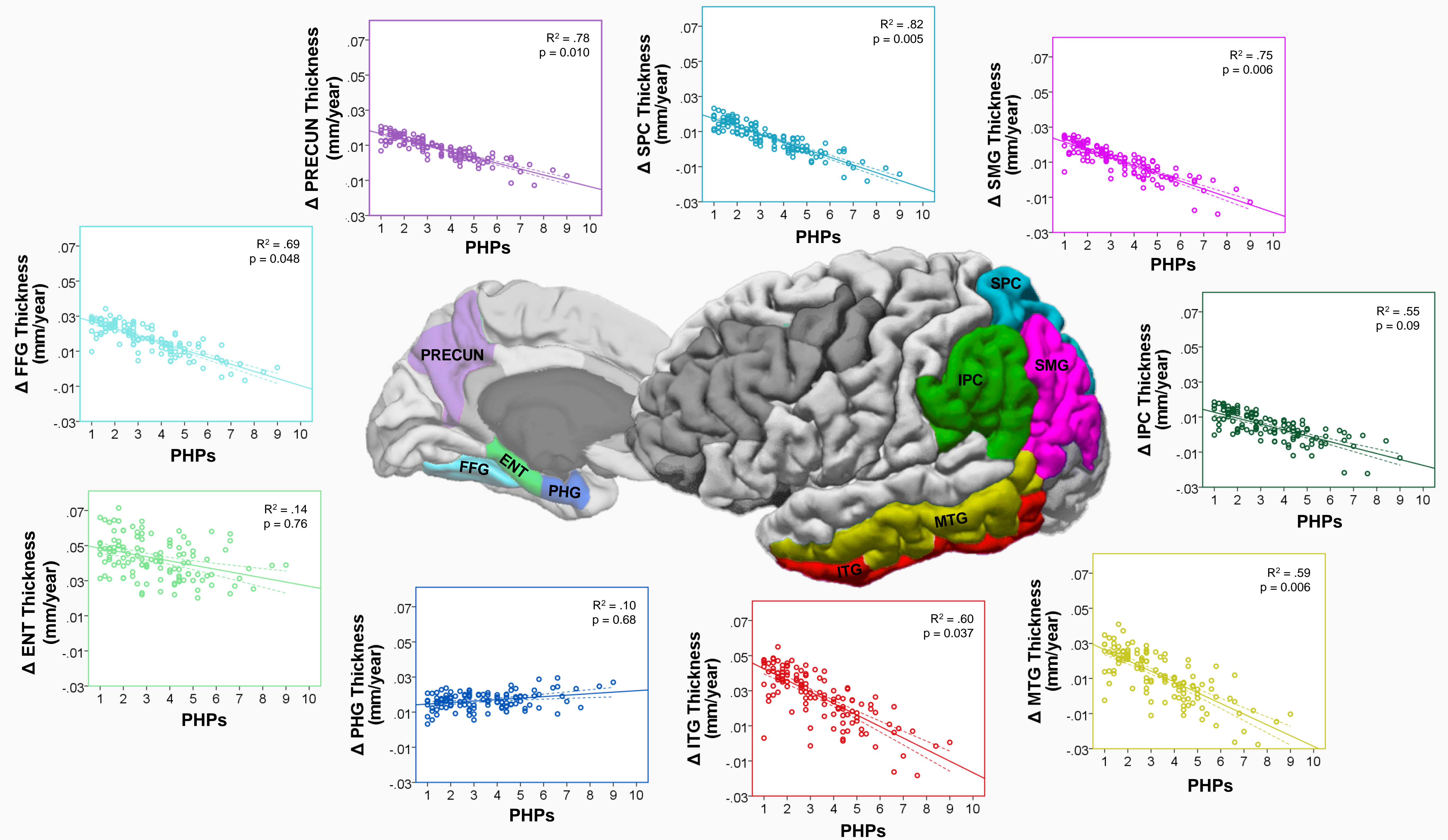
$$\text{Change in thickness} = \frac{\text{Thickness at last MRI} - \text{Thickness at 1}^{st}\text{ MRI}}{\text{Time between 1}^{st}\text{ and last MRI}}$$

- All regressions included age at most recent MRI, sex, and literacy as covariates

RESULTS

Scatter plots of change in bilateral thickness vs. Perceived Hearing Problems (PHPs)

Abbreviations: ENT=entorhinal cortex, FFG=fusiform gyrus, IPC=inferior parietal cortex, ITG=inferior temporal gyrus, MTG=middle temporal gyrus, PHG=parahippocampal gyrus, PRECUN=precuneus, SMG=supramarginal gyrus, SPC=superior parietal cortex

Δ PRECUN Thickness (mm/year): $R^2 = .78$, $p = 0.010$

Δ SPC Thickness (mm/year): $R^2 = .82$, $p = 0.005$

Δ SMG Thickness (mm/year): $R^2 = .75$, $p = 0.006$

Δ FFG Thickness (mm/year): $R^2 = .69$, $p = 0.048$

Δ IPC Thickness (mm/year): $R^2 = .55$, $p = 0.09$

Δ ENT Thickness (mm/year): $R^2 = .14$, $p = 0.76$

Δ PHG Thickness (mm/year): $R^2 = .10$, $p = 0.68$

Δ ITG Thickness (mm/year): $R^2 = .60$, $p = 0.037$

Δ MTG Thickness (mm/year): $R^2 = .59$, $p = 0.006$

CONCLUSIONS

- Findings demonstrated **greater rates of thinning** in several AD signature regions among clinically unimpaired adults **with greater PHPs**

- Higher rates of atrophy in these regions may be responsible for early auditory deficits observed in individuals who go on to develop symptomatic AD

- Accordingly, additional follow-up will reveal whether thinning in these cortical regions and/or PHPs predict prospective decline in cognitive status

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